Ultra-High-Energy Cosmic Rays and Neutrinos from relativistic jets of Active Galactic Nuclei

Rostom Mbarek, Damiano Caprioli, and Kohta Murase

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What is this contribution about? We propagate particles in relativistic magnetohydrodynamic (MHD) jet simulations to study i) the acceleration of ultra-high energy cosmic rays (UHECRs) through *espresso*, a one/multiple-shot acceleration mechanism, ii) the effects of losses on accelerated particles, and iii) the expected spectrum of neutrinos produced by typical jets of active galactic neuclei (AGN).

Why is it relevant/interesting? This contribution presents the first—to our knowledge—self-consistent comprehensive framework that accounts for particle injection, particle acceleration, spectra of UHECRs, effects of losses, and the resulting neutrino spectral features in AGN jets.

What have we done? We have developed a framework—agnostic to particle acceleration mechanisms—where trajectories are integrated via standard particle-in-cell techniques in relativistic MHD jet simulations, augmented with a Monte Carlo treatment of sub-grid pitch-angle scattering and realistic photon field prescriptions.

What is the result?

1. UHECRs are *espresso*-accelerated independently of the sub-grid scattering rate. Stochastic acceleration is relevant for low-energy particles.
2. UHECRs are not significantly affected by photodisintegration in AGN jets, which is consistent with Auger's detection of heavy elements at the highest energies.
3. The source neutrino flux at $E_\nu > 10^{17}$eV should be comparable to that of cosmogenic neutrinos, and the steady neutrino emission from AGN jets cannot account for IceCube's signal. However, since nonthermal photons are the dominant background for interactions, AGN flares may be potential candidates for multimessenger signals.